Patent Claims

1. Transport pipe for high viscosity materials, in particular for concrete, with an inner pipe (10) made of an abrasion-resistant plastic, at least one joint element (12) materially joined to an external end of the inner pipe (10), which includes a radially extending collar (16) and a ring sleeve concentric to the inner pipe (10) extending axially from one side thereof, as well as a reinforcing jacket (14) enclosing at least the internal pipe and connected thereto and to the joint element (12), **thereby characterized,** that the radially projecting collar (16) of the joint element (12) is defined by a ring shaped end face (20) and by a thereto joined ring step (22) extending radially towards the inside of the pipe and recessed axially from the ring-shaped end face (22), and that the plastic material of the inner pipe (10) engages from the inside of the pipe in the ring step (22).

2. Transport pipe according to Claim 1, thereby characterized, that the plastic material of the inner pipe (10) fills the free area (24) bordered by the ring step (22) of the collar and thereby forms an on the end face (20) of the collar (16), radially inward, an end face part (26) preferably aligned or joining flush.

3. Transport pipe according to Claim 1 or 2, thereby characterized, that extending from the recessed border surface of the ring step (22) a diagonal or curved

transition surface (28) extends in the axial direction to the inner radius of the inside of the cylindrical ring sleeve (18).

4. Transport pipe according to one of Claims 1 through 3, thereby characterized, that the inner surface of the cylindrical inner pipe (10) exhibits an opening which is slanted or curved diverging towards the end face (20, 26) of the collar (16).

5. Transport pipe according to one of Claims 1 through 4, thereby characterized, that the reinforcing jacket (14) is a steel pipe, on the ends of which the ring sleeve (18) of the, preferably truncated, joint element (12) is welded.

6. Transport pipe according to Claim 5, thereby characterized, that the inner pipe (10) is a wear resistant inner coating for the steel pipe (14) and the attached joint element (12).

7. Transport pipe according to one of Claims 1 through 4, thereby characterized, that the ring sleeve (18) of the joint element exhibits an outer surface (34) with outer diameter varying in the axial direction, and that the reinforcing jacket (14) is formed by a fiber structure impregnated in a plastic matrix and tightly cohesively wound externally on the inner pipe (10) and the ring sleeve (18) of the joint element (12), which reinforcing jacket (14) is connected with the outer surface (34) of the ring sleeve (18) form-fittingly and in certain cases materially joined.

8. Transport pipe for high viscosity materials, in particular for concrete, with

- an inner pipe (10) made of an abrasion-resistant plastic,

- at least one joint element (12) materially joined to an external end of the inner pipe (10), which includes a radially extending collar (16) and a ring sleeve concentric to the inner pipe (10) extending axially from one side thereof, as well as

- a reinforcing jacket (14) which envelops at least the internal pipe and is connected thereto and to the joint element (12),

thereby characterized, that the ring sleeve (18) of the joint element exhibits an outer surface (34) with outer diameter varying in the axial direction, and that the reinforcing jacket (14) is formed by a fiber structure impregnated in a plastic matrix and tightly cohesively wound externally on the inner pipe (10) and the ring sleeve (18) of the joint element (12), which reinforcing jacket (14) is connected with the outer surface (34) of the ring sleeve (18) form-fittingly and in certain cases materially joined.

9. Transport pipe according to Claim 7 or 8, thereby characterized, that the fiber structure is fiber cable or thread, fiber tape, fabric tape or mat.

10. Transport pipe according to one of Claims 7 through 9, thereby characterized, that the fiber structure contains fiber material from the group consisting of carbon fiber, glass fiber, aramide fiber and/or polyester fiber.

11. Transport pipe according to one of Claims 7 through 10, thereby characterized, that the fiber structure includes fiber layers laid axially and/or radially.

12. Transport pipe according to one of Claims 7 through 11, thereby characterized, that the ring sleeve (18) exhibits a wave shape running in the axial direction.

13. Transport pipe according to one of Claims 7 through 11, thereby characterized, that the ring sleeve (18) exhibits a shape which in the axial direction is trapezoid shaped, step shaped, grooved or knurled.

14. Transport pipe according to one of Claims 7 through 13, thereby characterized, that the joint element (12) is provided with pins, about which the fiber structure is laid forming loops.

15. Transport pipe according to one of Claims 7 through 14, thereby characterized, that the reinforcing jacket (14) and the joint element (12) are bolted together.

16. Transport pipe according to one of Claims 7 through 15, thereby characterized, that on the two ends of the inner pipe (10) respectively one joint element (12) is provided,

the joint element (12) including a ring sleeve (18) which on the outer surface is waved shaped.

17. Transport pipe according to one of Claims 7 through 15, thereby characterized, that only on one, preferably the entry side, end of the inner pipe (10) a joint element (12) with ring sleeve (18) waved on the outside is provided, while on the other, preferably the exit, end a joint element (44) with external flat ring sleeve (46) is adhered.

18. Transport pipe according to one of Claims 7 through 17, thereby characterized, that the ring sleeve (18) of the joint element (12) becomes tapered on its free end opposite to the collar (16).

19. Transport pipe according to one of Claims 7 through 18, thereby characterized, that the wave contour of the outer surface of the ring sleeve (18), towards its free end, becomes more shallow.

20. Transport pipe according to one of Claims 7 through 19, thereby characterized, that the wave contour on the outer surface exhibits, immediately adjacent the collar (16), an axially joining, sharp edged radial rebounding wave valley (40).

21. Transport pipe according to one of Claims 7 through 20, thereby characterized, that between the wave valley (40) closest to collar and the free end of the ring sleeve (18)

at least two wave peaks (38) appear separated from each other by at least one further wave valley (42).

22. Transport pipe according to one of Claim 7 through 21, thereby characterized, that the sequential wave peaks (38) exhibit a decreasing radial height going towards the free end of the ring sleeve (18).

23. Transport pipe according to one of Claims 1 through 22, thereby characterized, that the inner pipe (10) is comprised of wear resistant polyurethane.

24. Transport pipe according to one of Claims 1 through 23, thereby characterized, that the inner pipe (10) is cast on to the joint element (12), preferably via an adhesion promoter or primer applied over the joint element.

25. Transport pipe according to one of Claims 7 through 24, thereby characterized, that the fiber structure embedded in the plastic matrix is materially joined with the inner pipe (10) with the formation of a closed reinforcing jacket (14).

26. Transport pipe according to one of Claims 7 through 25, thereby characterized, that for the plastic matrix a plastic material is selected from the group consisting of epoxy resin, polyester resin, vinyl resin, and thermal plastic resin.

27. Transport pipe according to one of Claims 1 through 26, thereby characterized, that the joint element (12) is metal, preferably steel.

28. Transport pipe according to one of Claims 1 through 26, thereby characterized that the joint element (12) is comprised of a plastic molded part reinforced with fiber, preferably injection molded or produced in a press mold.

29. Process for producing a transport pipe for viscous material, in particular for concrete, with the following process steps:

- at least one premanufactured metallic joint part provided with a collar (16) and an externally wave shaped ring sleeve (18) is introduced on one end of a casting mold which is then cast with a reaction plastic which is wear resistant in the cured state with formation of an inner pipe with a collar at one end;

- the finished internal pipe with collar or flange is wound about with a plastic impregnated carbon fiber from one end to the other with the formation of the externally wave shaped ring liner and formation of a cohesive reinforcing jacket;

- the finished transport pipe is heated for a period as necessary for curing of the plastic matrix and/or for production of a form-fitting joint with the inner pipe and the joint element (12).

30. Process according to Claim 29, thereby characterized, that the joint element (12) is coated with an adhesion promoter or primer on its contact surfaces with the inner pipe (10) prior to the casting process.

31. Process according to one of Claims 29 or 30, thereby characterized, that the inner pipe and/or the joint element is coated with an adhesion promoter or primer on its surfaces contacting with the casing pipe prior to the wrapping process.

32. Process according to one of Claims 29 through 31, thereby characterized, that as the plastic matrix a plastic from the group epoxy resin, polyester resin, and vinyl resin, thermoplastic is employed.

33. Process according to one of Claims 29 through 32, thereby characterized, that the fiber cord or thread or the fabric tape is wound by means of a multi-axis winding machine with rotation of the inner pipe about its axis.

34. Process according to Claim 33, thereby characterized, that the inner pipe with collar is seated fixed against rotation upon a winding core, and that the winding core is rotated about the axis of the inner pipe by a motor during the winding process.

35. Process for producing a transport pipe for viscous matter, in particular concrete, with the following process steps:

- at least one premanufactured joint element (12) including a collar (16) and a ring sleeve (18), the ring sleeve (18) wave shaped on the outside, is wound about with a plastic impregnated carbon fiber cord to form a carbon fiber composite pipe;

- then the produced carbon fiber composite pipe is cleansed on the inside and the joint element is cleansed on its free contact surfaces and coated with an adhesion promoter;

- subsequently a reaction plastic is introduced into the carbon fiber composite pipe with its at least one collar, forming an inner coating, and as such is cured.

36. Process according to Claim 35, thereby characterized, that after the coating with the adhesion promoter a core with smaller dimension is introduced into the inside of the carbon fiber composite pipe provided with at least one collar (16), with maintaining free a ring gap, and that subsequently the reaction plastic is introduced into the ring gap, is cured there, and the core is again removed.

37. Process according to Claim 36, thereby characterized, that the reaction plastic is sprayed or spun on the inner surface of the carbon fiber composite pipe provided with at least one collar and coated with the adhesion promoter, and that the reaction plastic is subsequently cured.

38. Use of the transport pipe according to one of Claims 1 through 19 for employment in conjunction with mobile or stationary concrete pumps.

39. Use of the transport pipe according to one of Claims 1 through 19 for employment in a concrete distribution boom in mobile or stationary concrete pumps.